

# VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

## Valley Regional Office

### INTRA-AGENCY MEMORANDUM

4411 Early Road - P. O. Box 3000

Harrisonburg, VA 22801-3000

<b>Permit Writer</b>	Debbie D. Medlin	<b>Date</b>	<i>DRAFT</i>	
<b>Air Permit Manager</b>	Janardan R. Pandey	<b>Date</b>		
<b>Memo To</b>	Air Permit File			
<b>Facility Name</b>	Columbia Gas – Strasburg Compressor Station			
<b>Registration Number</b>	81286			
<b>County-Plant I.D.</b>	N/A			
<b>UTM Coordinates (Zone 17)</b>	730.0	<b>Easting (km)</b>	4320.9	<b>Northing (km)</b>
<b>Elevation (feet)</b>	694			
<b>Distance to Nearest Class I Area (select one)</b>	19	<b>SNP (km)</b>	--	<b>JRF (km)</b>
<b>FLM Notification Required (Y/N)</b>	Y			
<b>AIRS Classification (A, SM, SM80, B)</b>	SM-80	<b>Before permit action</b>	A	<b>After permit action</b>
<b>Pollutants for Which the Source is Title V Major</b>	N/A	<b>Before permit action</b>	NO <sub>x</sub> and CO	<b>After permit action</b>
<b>PSD Major Source (Y/N)</b>	N	<b>Before permit action</b>	N	<b>After permit action</b>
<b>Pollutants for Which the Source is PSD Major</b>	N/A	<b>Before permit action</b>	N/A	<b>After permit action</b>

## **I. Introduction**

Columbia Gas Transmission, L.L.C. (Columbia Gas), of Charleston, West Virginia, submitted an application dated December 17, 2015, that was received by the DEQ on January 19, 2016, to modify and operate its Strasburg natural gas compressor station facility located two miles north of Strasburg in Shenandoah County. The Strasburg Compressor Station is part of Columbia Gas' interstate gas transmission system.

The Columbia Gas Strasburg Compressor station has one minor NSR permit dated June 6, 2014, as amended April 6, 2015. The facility submitted a state major permit application for the installation of three additional compressor turbines and a natural gas-fired emergency generator, along with two gas-fired heaters and 35 catalytic heaters. The existing Solar Titan 130 turbine will be uprated. Columbia Gas plans to remove the two existing European Gas Tornado turbines, the existing air compressor station, and two emergency generators.

The application was considered complete on August 12, 2016 upon receipt of hourly emission limits for the turbines at 0 °F.

## **II. Emission Unit(s) / Process Description(s)**

Columbia Gas desires to construct a number of emission units as part of a facility expansion. The project includes the following equipment:

- Two Solar 70 Taurus natural gas-fired compressor turbines (Ref. E04 and E05), maximum rated input heat capacity of 90.74 MMBtu/hr at 32 degrees Fahrenheit (°F);
- One Solar 100 Taurus natural gas-fired compressor turbine (Ref. E06), maximum rated input heat capacity of 133.0 MMBtu/hr at 32 degrees Fahrenheit (°F);
- One 880 bhp natural gas-fired emergency generator;
- Two process heaters; and
- 35 catalytic heaters.

Columbia Gas plans to modify (uprate) the existing Solar 130 Titan compressor turbine, which had previously been limited by the Federal Energy Regulatory Commission (FERC) to 17,800 hp. The unit will be uprated so that it can operate at full load (site rated at 19,796 hp at 32 degrees F).

Remove the following existing equipment:

- Two 8,576 bhp EGT Tornado turbines (natural gas-fired);
- One Waukesha 260 hp natural gas-fired emergency reciprocating engine;
- One Wisconsin 37 bhp reciprocating engine/air compressor (natural gas-fired); and

- 2.1 MMBtu/hr Hydrotherm MR-1500-PBV Heating System Boiler (natural gas-fired)

The turbines are equipped with Solar's dry low NO<sub>x</sub> (DLN) combustion system (known as SoLoNO<sub>x</sub>), which limits the formation of NO<sub>x</sub> by pre-mixing air and fuel prior to combustion. This system limits NO<sub>x</sub> emissions to 15 ppmv when the turbine is operating at an ambient temperature of 0° F or greater and at a load equal to or greater than 50%. This technology reduces nitrogen oxide (NO<sub>x</sub>) emissions without using steam or water injection in natural gas-fired units by operating using a lean burn fuel ratio (fuel to air ratios of less than 1:1). The SoLoNO<sub>x</sub> system does not operate during start-up or shutdown. SoLoNO<sub>x</sub> efficiency is diminished at low loads, as well as at full load for temperatures < 0° F.

Power output and the exhaust gas flow rate are functions of the ambient conditions; the mass flow of the exhaust gas will increase as the site temperature decreases due to the increase in the density of the combusted air. Power output is also impacted by the load on the turbine's compressor. Because of these variations, the emissions concentrations are given for the indicated temperature ranges. Preferred operation will be at normal load with ambient temperature greater than or equal to 0° F.

Emissions of NO<sub>x</sub>, CO, and VOC from the four turbines (Ref. E03, E04, E05, and E06) were calculated by the facility using vendor performance data. The annual emission rate of these criteria pollutants are based on the combination of the turbines' potential operating modes, which are:

- Normal operating load at 32 degrees F (Normal),
- Low temperature operating mode for operation at -20° F to less than 0° F (Low Temp),
- Low-Load for operation at less than 50 percent of full load capacity (<50%), and
- Startup / Shutdown mode.

Startup/Shutdown emissions were developed based on the lb/event numbers provided in PIL 170. VOC emissions are based on 20 percent of unburned hydrocarbons, per Solar Product Information Letter (PIL) 168.

Each turbine's operational limits, in lb/hr, is listed as an attachment to this memorandum, as well as in an attachment to the permit.

In all configurations, SO<sub>2</sub>, PM, PM<sub>10</sub>, and PM<sub>2.5</sub> will remain constant, as they are not affected by the HHV of the fuel. Regarding SO<sub>2</sub> emissions, 40 CFR 60 Subpart KKKK allows a sulfur (S) concentration of 0.06 lb/MMBtu, ~21.4 grains S per 100 standard cubic feet (~21.4 gr/100 scf). In its application, Columbia Gas used a value of 0.25 gr/100 scf of natural gas to determine its annual emissions of SO<sub>2</sub> from the four turbines E03, E04, E05, and E06, and 20 gr/100 scf to determine the maximum short-term (lb/hr) SO<sub>2</sub> emission limits. The given annual S concentration value of 0.25 gr/100 scf of

natural gas is a decrease from the historical pipeline natural gas S concentration of 2 gr S/100 scf (0.0056 lb/MMBtu).

Columbia Gas obtained the PM species (PM<sub>10</sub> and PM<sub>2.5</sub>) emission factor of 6.6E-03 lb/MMBtu from AP-42 (Table 3.1-2a (4/00)), though the vendor recommended use of a supplied value for PM<sub>10</sub> and PM<sub>2.5</sub> emissions of 0.018 lb/MMBtu; both are based on the higher heating value (HHV) of the natural gas. In a vendor technical publication sent to DEQ by Columbia Gas in a previous CEDS action, the vendor had cautioned against using PM species' values from AP-42, because of the inconsistent, usually higher, results achieved by testing firms. However, Columbia Gas indicated in an e-mail on April 19, 2016 that it planned to use the AP-42 for the natural gas EF instead of the vendor value. Columbia Gas preferred use of the AP-42 value over the recommended vendor EF, considering that it was the more conservative value for natural gas.

In the absence of another source for the PM emission factor, DEQ used the filterable portion of the PM factor from AP-42 (1.9E-03 lb/MMBtu), Table 3.1-2a (4/00).

### III. Regulatory Review

#### A. 9 VAC 5-80-1100 et seq. (Article 6) - Minor New Source Review

Minor NSR permitting applicability is based on the uncontrolled emission rate increase (UEI) of criteria pollutants for the project as defined in the Regulations. This project includes the three new turbines, two of which are rated at 90.74 MMBtu/hr at 32 °F, one rated at 133.0 MMBtu/hr at 32 °F, and the 880 bhp natural gas-fired generator engine. It also includes the existing Solar 130 turbine, which will undergo a rating increase from 17,800 hp to full load operation at 19,796 hp at 32 °F. The two gas heaters and the catalytic heaters are both exempt from permitting based on their individual size as external fuel combustion units using gaseous fuel with a maximum heat input of less than 50 MMBtu/hr, per 9 VAC 5-80-1105 B.1.a(4).

The UEI for criteria pollutants is calculated as the sum of the new uncontrolled emissions (NUE) increases from each of the new equipment pieces along with the new emissions from the uprated Solar 130 turbine (E03), less the current uncontrolled emissions (CUE), or  $UEI = NUE - CUE$ . CUE is listed only for the existing Solar Titan 130 compressor turbine (E03) as the other units being considered for permitting applicability are new units, with a corresponding CUE of "0". The CUE values listed for the Solar Titan 130 are the permitted values as stated in the facility's current permit.

The UEI is then compared to the criteria pollutant exemptions levels in 9 VAC 5-80-1105. If the UEI exceeds the exemption level for any one criteria pollutant, the source is subject to the permitting requirements of 9 VAC 5 Chapter 80, Article 6.

The UEI is set forth in Table 1 below. The NUE is the maximum emissions, at 8760 hours, from the four turbines, and 500 hours from the emergency generator, when firing natural gas. Table 1, below, shows the emissions increase associated with this action. Individual uncontrolled emissions for each turbine and the emergency generator may be seen in Table 1 of Attachment A (Calculations - Uncontrolled).

**Table 1: Uncontrolled Emission Rate Increase (UEI)**

<b>Pollutant</b>	<b>NUE</b>	<b>CUE <sup>1</sup></b>	<b>UEI (NUE – CUE)</b>	<b>Exemption Threshold <sup>2</sup></b>	<b>Exempt? (Yes/No)</b>
	<b>(tpy)</b>	<b>(tpy)</b>	<b>(tpy)</b>	<b>(tpy)</b>	
PM	4.44	1.3	3.14	15	Yes
PM-10	13.76	12.2	1.56	10	<b>No</b>
PM-2.5	13.76	12.2	1.56	6	<b>No</b>
NO <sub>x</sub>	115.67	37.1	78.57	10	<b>No</b>
SO <sub>2</sub>	1.49	3.8	-2.31	10	Yes
CO	247.49	83.9	163.59	100	<b>No</b>
VOC	63.5	4.7	58.80	10	<b>No</b>

<sup>1</sup> CUE emissions are only for the Solar 130 turbine (Ref. E03), as it is the only unit with existing permit limits that are being modified. All other units considered for permitting applicability are new.

<sup>2</sup> Exemption thresholds taken from 9 VAC 5-80-1105 D for projects.

Under Article 6, a project can be subject to State Major permitting if the change in the potential to emit (PTE), which is the difference between the allowables after permit issuance and the allowables prior to the project, exceeds 100 tons per year. Columbia Gas plans to operate each of the turbines at the Strasburg Compressor Station for 8760 hours per year. In this operating scenario, CO emissions will exhibit greater than a 100 tpy increase, as seen in Table 2.

Per 9 VAC 5-60-320, if a stationary source is not exempt under 9 VAC 5-60-300 C, D, or E, then the owner shall employ BACT for the control of toxic pollutants. Toxic pollutants may not be emitted at rates that will contribute to any significant ambient air concentration (SAAC).

Because minor NSR permitting is triggered by the criteria pollutants' UEI, there is no need to evaluate the air toxic pollutant potential to emit (PTE) for permitting applicability, the requirements of which are listed in 9 VAC 5-80-1105 E or F.

However, based on the application, the modified Strasburg Compressor Station will emit air toxics. In this case, the uncontrolled hourly and annual emissions of formaldehyde (CAS No. 50-00-0) from the four turbines exceed the respective exemption thresholds, as calculated from the formula listed in 9 VAC 5-60-300 C.1.b. for toxic pollutants with both a TLV-STEL<sup>®</sup> and a TLV-TWA<sup>®</sup>.

Other air toxics or hazardous air pollutants (HAP) are also emitted from the four turbines and the emergency generator engine. Although the HAP summed values are listed in the facility PTE table (Section IX, Table 5) they are each less than their individual hourly and annual exemption thresholds, with the lone exception of formaldehyde.

Although it appears that some of the turbines are replacement units, the facility has not specifically annotated said turbines as replacement units. Further, it is not clear which turbine is replacing which. As such, E04, E05, and E06 are treated as new units.

#### ***Permitting Triggered***

The proposed project, the installation of three compressor turbines and one emergency generator, and the modification of an existing compressor turbine at the Strasburg Compressor Station, will trigger permitting for criteria pollutants NO<sub>x</sub>, CO, and VOC, and for the state air toxic, formaldehyde. The proposed permit shall supersede the current permit dated June 6, 2014, as amended April 6, 2015.

#### **B. 9 VAC 5 Chapter 80, Article 8 - PSD Major New Source Review**

By itself, this project does not have a major stationary source PTE. After issuance of this permit, the facility does not have the PTE of any NSR-regulated pollutant major stationary source threshold. PSD review does not apply.

#### **C. 9 VAC 5 Chapter 50, Part II, Article 5 - NSPS**

##### ***Turbines (E03, E04, E05, and E06)***

The proposed Solar turbines (E04, E05, and E06) are subject 40 CFR 60, Subpart KKKK, *Standards of Performance for Stationary Combustion Turbines* (§60.4300 - §60.4420). The existing Solar turbine (E03), proposed for modification, continues to be subject to the said subpart. Subpart KKKK applies to stationary combustion turbines with a heat input at peak load greater than or equal to 10 MMBtu/hr based on the higher heating value (HHV) of the fuel, which commenced construction, modification or reconstruction after February 18, 2005.

Turbines manufactured on or prior to February 18, 2005 are subject to 40 CFR 60, Subpart GG, *Standards of Performance for Stationary Gas Turbines*. The existing EGT Tornado turbines (E01 and E02), subject to 40 CFR 60, Subpart GG, are being removed from the facility and the permit, as they are being replaced with the proposed turbines (E04, E05, and E06).

Principal requirements of the Subpart KKKK are as follows:

-Subpart KKKK regulates the emissions of NO<sub>x</sub> and SO<sub>2</sub> from the proposed new turbines (E04, E05, and E06) and the turbine (E03), which is proposed for modification. Primary applicable requirements are as follows:

NO<sub>x</sub>

-Emission standard (40 CFR 60.4320(a)), as referenced in Table 1 to the subpart - 15 ppm NO<sub>x</sub>, at 15% O<sub>2</sub> or 54 ng/J of useful output (0.43 lb/MWh) for a new, modified or reconstructed combustion turbine firing up to 850 MMBtu/hr (HHV) at peak load;

-Control Practices (40 CFR 60.4333) - Minimize emissions at all times including startup, shutdown, and malfunction;

-Initial Annual Performance Test – required per 40 CFR 60.4340 in accordance with §60.4400. If the NO<sub>x</sub> emission result for the performance test is less than or equal to 75 percent of the NO<sub>x</sub> emission limit for the turbine, the permittee may reduce the frequency of subsequent performance tests to once every two years (no greater than 26 months following the previous performance test).

-Annual performance tests, as compliance for units not using water or steam injection (40 CFR 60.4340) – Perform annual performance tests in accordance with 40 CFR 60.4400 to demonstrate continuous compliance. Although the Subpart offers continuous emissions monitoring system (CEMS) or parametric monitoring as an alternative to the annual performance test, the facility has selected annual performance tests.

SO<sub>2</sub>

-Sulfur Monitoring Exemption (40 CFR 60.4360) – The permittee must monitor the total sulfur content of the fuel being fired in the turbines, or be exempted from monitoring by 40 CFR 60.4365 and demonstrate compliance either by fuel quality characteristics required in 40 CFR 60.4365(a) or representative fuel sampling data required in 40 CFR 60.4365 (b).

General

-Annual Performance Test Results (40 CFR 60.4375(a)) – Written reports to the EPA administrator by close of business on the 60<sup>th</sup> day after performance test.

*40 CFR 60, Subpart OOOO - Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution* – The four compressor turbines are not subject to this subpart per §5365 because they are part of a natural gas transmission facility. Strasburg Compressor Station is not involved in natural gas production.

Emergency Generator (G3)

*40 CFR 60, Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines* – The emergency generator engine is NOT subject to this subpart because it is not compression ignition-fired.

*40 CFR 60, Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines* – The 880 bhp generator engine (G3) is subject to this subpart because it is spark ignition fired, and is considered ‘new’ equipment due to its manufacture date later than April 1, 2006. Virginia has not accepted delegation of this rule so no subpart specific permit conditions are required; however, the facility is notified via wording in the cover letter.

D. 9 VAC 5 Chapter 60, Part II, Article 1 – NESHAPS

There are no NESHAP standards applicable to the proposed change.

E. 9 VAC 5 Chapter 60, Part II, Article 2 - MACT

*40 CFR 63, Subpart YYYY – National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines* – This subpart is applicable to stationary combustion turbines located at a major source of HAP emissions. This subpart does NOT apply to the Strasburg natural gas compressor station as it will be an area source of HAP upon installation of the proposed turbines.

*40 CFR 63, Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines* – The proposed generator engine (G3) is subject to the Subpart ZZZZ, as an area source. An area source of HAP emissions is a source that is not a major source. As Virginia does not accept delegation of authority for this particular MACT, the permit cover letter will include notification to the facility of the applicability of Subpart ZZZZ.



F. 9 VAC 5 Chapter 40, Part II - Existing Sources - Emission Standards

The turbines are not fuel burning equipment per the definition in 9 VAC 5-40-880. Therefore, Rule 4-8 does not apply.

IV. **Best Available Control Technology (BACT) Review (9 VAC 5-50-260 and/or 9 VAC-5-60-320)**

A project shall apply BACT for each regulated pollutant for which there would be an increase in the uncontrolled emission rate equal to or greater than the levels in 9 VAC 5-80-1105 D. This requirement applies to each affected emissions unit in the project. Additionally, if a stationary source is not exempt under 9 VAC 5-60-300 C, D, or E, then the owner shall employ BACT for the control of toxic pollutants. As shown in Table 1 above (Section III.A), BACT applies to NO<sub>x</sub>, CO, VOC, and formaldehyde. As part of the application, Columbia Gas submitted a BACT analysis for NO<sub>x</sub>, CO, and VOC from the three proposed turbines and the existing turbine, which will be updated. A copy of the full BACT analysis is provided in Attachment E; a summary is provided below.

Turbines - Control Technology Review:

NO<sub>x</sub>:

For NO<sub>x</sub> emissions control, the only commercially available option is selective catalytic reduction, a post-combustion technology. The reduction of NO<sub>x</sub> emissions are greater than 90% for SCR with natural gas firing. Columbia Gas reviewed the Pennsylvania Department of Environmental Protection's (PADEP's) issuance of a General Permit in January 2013 for natural gas compression and /or processing facilities. Included within the technical support document are 2013 analyses for the use of SCR on compressor turbines of various sizes. The document details the cost effectiveness for SCR technology in a range from \$71,000 to \$76,000 per ton of NO<sub>x</sub> removed for turbines rated equal to or greater than 5,000 bhp to 15,000 bhp. For turbines rated greater than 15,000 bhp, SCR technology ranges from \$69,000 to \$71,000 per ton of NO<sub>x</sub> removed. The lowest rated Solar turbines in the project are the Solar Taurus 70 turbines (E04 and E05), which are rated at 10,999 at 32 °F. SCR technology would be cost prohibitive. Columbia Gas proposes the use of Solar's dry low NO<sub>x</sub> (DLN) combustion system, known as SoLoNO<sub>x</sub>, as BACT. This system limits the formation of NO<sub>x</sub> by pre-mixing air and fuel prior to combustion, as indicated in Section II.

CO and VOC:

For CO and VOC control, the same document provided an analysis of the use of oxidation catalyst technology, which uses precious metals or metal oxides which oxidize the CO and hydrocarbons to CO<sub>2</sub> and H<sub>2</sub>O. Over 75% of CO emissions can be controlled using this method. The PADEP reviewed the use of catalyst technology with a 90%

reduction level at a facility in Easton, Pennsylvania using the Taurus 70 turbines. Based on PADEP projections using the Taurus 70 turbine model, Columbia Gas completed cost analysis for the units proposed for installation at the Strasburg Compressor Station. The economic analysis revealed costs of \$10,100 per ton of CO removed for each Taurus 70. For the Mars 100, the cost per ton of CO removed is estimated at \$7,900, and \$6,200 per ton of CO removed for the Titan 130. The \$6,200 estimated for the Titan 130 model is that for a new unit; a retrofit cost would be higher.

For the Strasburg Compressor Station, the amount of VOC removed using oxidation catalyst technology is estimated to be minimal at no greater than 2 tons per year.

Columbia Gas recommends good combustion practices in accordance with manufacturer's specifications and procedures as BACT for CO and VOC removed, along with the use of the SoLoNOx system in its proposed three new turbines, and one modified turbine. The SoLoNOx system is inherent to the turbines' design. DEQ concurs with this.

VOC emissions from venting account for the majority of VOC emissions from the proposed and modified turbines. Approximately 95 percent of the venting in the four turbines is due to blowdowns that are a function of the shutdown procedure. Although Columbia Gas has calculated one blowdown emission event per each shutdown cycle, said calculation is a conservative estimate. Good operation and maintenance practices may prevent some blowdowns, and minimize some shutdowns, from having to occur. DEQ will require work practice standards to minimize venting from the four turbines. There will be no emission limits for the venting; only recordkeeping will be required.

Additional BACT controls for CO, NO<sub>x</sub>, and VOC from the turbines are as follows:

- Restriction on fuel use to natural gas only;
- Adherence to short-term emission limits and concentrations for NO<sub>x</sub>, CO, and VOC;
- Adherence to annual emission limits at noted concentrations for NO<sub>x</sub>, CO, and VOC;
- and
- Work practice standards for VOC.

#### Emergency Generator

The 880-hp natural gas-fired emergency generator is not a significant source of emissions in this project. As such, add-on control technologies are not considered. BACT for CO and NO<sub>x</sub> from the emergency generator will consist of:

- Proper engine operation in accordance with the manufacturer's written instruction, or procedures developed by the permittee that are approved by the manufacturer;
- Restriction on fuel use to natural gas only; and

- A limitation on the use of the emergency generator to emergency situations only. This allows for the use of maintenance checks and readiness testing, as required by federal, state, or local governments, the manufacturer, the vendor or insurance company associated with the engine.

## V. Summary of Controlled Emissions Increase

Table 2 includes the proposed source's potential to emit criteria and toxic air pollutants. The controlled emissions increases are the sum of the proposed emission limits on permitted equipment less the sum of the current permitted emission limits of facility equipment that will be removed.

Because the facility will continue to operate throughout the proposed modification, the proposed permit will include a section from the current permit, allowing operation of the current turbines E01 and E02 until the proposed and modified turbines are ready for operation. Condition 32 in the permit details facility turbine operations during the new turbines' shakedown period.

**Table 2: Controlled Emissions Increase for Reg. #81286**

Poll.	Proposed Allowable Annual Emissions (tpy)						Permitted Allowable Annual Emissions (tpy)						Proposed Less Permitted Annual Emissions (tpy)	Modeling Signif. Level (tpy) <sup>(4)</sup>
	E03	E04 and E05	E06	G3	Htrs <sup>(1)</sup>	Sum (Prop.)	Max (E01+E02) or E03 <sup>(2)</sup>	AC1	G1	G2	Htr <sup>(3)</sup>	Sum (Perm.)		
NO <sub>x</sub>	38.9	43.8	32.0	0.97	2.32	117.99	85.6	3.80	1.52	0.64	0.9	92.46	25.53	40
CO	85.98	92.0	67.7	1.94	1.95	249.57	83.9	6.39	2.56	0.42	0.76	94.03	155.54	100
PM	1.3	1.5	1.1	0	0.06	3.96	1.3	0.03	0.01	0	0.02	1.36	2.6	25
PM-10	4.7	5.3	3.8	0.02	0.18	14	12.2	0.03	0.01	0.01	0.07	12.32	1.68	15
PM-2.5	4.7	5.3	3.8	0.02	0.18	14	12.2	0.03	0.01	0.01	0.07	12.32	1.68	10
VOC <sup>(5)</sup>	15.36	32.82	14.83	0.49	0.14	63.64	4.72	0.05	0.02	0.01	0.05	4.85	58.79	(6)
SO <sub>2</sub>	0.5	0.6	0.4	0	0.02	1.52	3.8	0	0	0	0.01	3.81	-2.29	40

<sup>(1)</sup> – Proposed heaters = the sum of the emissions from H2 (0.30 MMBtu/hr), H3 (0.25 MMBtu/hr), and SH2 (35 Catalytic heaters), plus existing heaters H1 (1.5 MMBtu/hr), and SH1 (0.072 MMBtu/hr).

<sup>(2)</sup> – E01 and E02 may not operate, except for readiness and maintenance testing, when E03 is in operation.

<sup>(3)</sup> – Currently permitted heater = BL1 (2.1 MMBtu/hr), which will be removed. H1 and SH1 will remain in operation at the facility; as such, they are not included in the Permitted Allowable Annual Emissions.

<sup>(4)</sup> – Modeling significance levels are taken from 9 VAC 5-80-1110.

<sup>(5)</sup> – VOC emissions increases from the turbines include those calculated from venting, though said emissions are not included in the permit. See Attachment A1, Table 2 for related calculations. .

<sup>(6)</sup> – VOCs are not modeled per agency policy.

<sup>(7)</sup> – Spreadsheet rounding may have a minor impact on certain values.

**Table 3: Strasburg Compressor Station Project Emissions (Toxics) – Uncontrolled<sup>1</sup>**

Pollutant	lb/hr	Exemption level (lb/hr)	tpy	Exemption level (tpy)
Formaldehyde (50-00-0)	0.36	0.0825	1.48	0.174

<sup>(1)</sup> The emissions noted are from the turbines E03, E04, E05 and E06. The proposed emergency generator, G3, is exempt from toxics review since it is in a source category, spark emission engines, regulated by an emission standard (40 CFR 63, Subpart ZZZZ).

<sup>(2)</sup> Modeling significance levels are calculated from the formula listed in 9 VAC 5-60-300 C.1.b.

As shown in Table 3, formaldehyde emissions from the four turbines exceed the hourly and annual exemption levels provided for in 9 VAC 5-60-300 C.1.b. The emissions were modeled by the Columbia Gas consultant AECOM, as requested by the DEQ, to show compliance with the hourly and annual SAAC. A state-only enforceable section of the permit was developed for the inclusion of the formaldehyde emissions from the turbines since they are above the hourly and annual exemption levels.

#### Hourly Emission Limits – Turbines

The hourly emission limits for the four turbines are based on the maximum operating temperature in normal mode at 0 °F. The annual emission limits are based on 32°F. Permit attachments contain hourly emission limits for NO<sub>x</sub>, CO, and VOC in alternative operating modes. The PM species and SO<sub>2</sub> will remain the same in all operating modes.

## **VI. Dispersion Modeling**

### **A. Criteria Pollutants**

As seen in Table 2, CO emissions exceed the modeling thresholds (PSD significance levels) as contained in the *DEQ New Source Review Permits Program Manual* (as revised April 1, 2002) and 9 VAC 5-80-1110. The DEQ Air Quality Assessment Group at Central Office has determined that no modeling will be completed for CO emissions because they expect that the values obtained from modeling will show that the CO emissions will be significantly less than air quality standards.

VOC emissions are not modeled per agency policy.

### **B. Toxic Pollutants**

Modeling is required if potential toxic air pollutant emissions exceed the exemption thresholds included in 9 VAC 5-60-300 C. Table 3 indicates that the Columbia Gas Strasburg Compressor Station exhibits a potential to emit formaldehyde that exceeds the thresholds of 9 VAC 5-60-300 C.1.b. As such, a modeling (dispersion) analysis was conducted to demonstrate whether the significant ambient air concentration (SAAC) levels would be maintained.

Dispersion modeling to predict formaldehyde impacts was performed using AERSCREEN version 15181 and MAKEMET version 15181 (meteorological data processing). Modeling was completed by AECOM, a consultant to Columbia Gas, and submitted to the Air Quality Assessment Group at Central Office for analysis. The results are as follows in Table 4:

**Table 4: Toxic Pollutant Analysis Maximum Predicted Concentrations**

Toxic Pollutant	Averaging Period	Maximum Modeled Concentration From Facility ( $\mu\text{g}/\text{m}^3$ )	SAAC ( $\mu\text{g}/\text{m}^3$ )	Percentage of SAAC (%)
Formaldehyde	1-hour	13.2	62.5	21.1
	Annual	0.117	2.4	4.9

Modeling results, as indicated above, demonstrate that formaldehyde does not exceed its hourly or annual SAAC value.

## **VII. Boilerplate Deviations / Changes from Existing Permit**

The permit was drafted using the *NSR PERMIT TEMPLATE VRO.doc* boilerplate. This permit is effectively considered a new permit because of the removal of most of the existing equipment. The lone exception to new equipment installation is that the existing Solar turbine (E03) will undergo a modification to uprate its maximum operating capacity. Effectively, all permit conditions will change with the exception of the General Conditions. As such, permit changes will not be listed.

The requirements of the existing permit will continue to be in effect until such time as the proposed units are readied for operation. Given this, the permit conditions governing the operation of the turbines E01, E02, and E03 (pre-modification) are listed as a separate section of the proposed permit.

The emergency generator (G3) has emission limits, all less than 0.5 tpy, listed in the draft minor NSR permit because the facility will be required to submit a TV application within 12 months from the start-up of the proposed units. DEQ guidance generally requires that emission limits that are less than 0.5 tpy not be placed in the minor NSR permit. However, listing the limits in both permits will assist in clarifying issues that arise from differences in the minor NSR and Title V permits. All emission limits are listed in the Title V permit.

No significant deviations were made from this boilerplate.

## VIII. Compliance Demonstration

Compliance for the four turbines with subpart KKKK will be determined as follows:

- Compliance with the NO<sub>x</sub> emission limit for the turbines (E03, E04, E05, and E06) will be demonstrated through stack testing according to the NSPS, Subpart KKKK. The performance (stack) testing requirement consists of initial and succeeding annual tests. The succeeding tests can be reduced to once every two years, as described in Section III.D above.
- Continuing compliance will be required with a NO<sub>x</sub> performance test on each turbines annually (no later than 14 calendar months following the previous performance test).
- Compliance with the Subpart KKKK SO<sub>2</sub> emission standard will be demonstrated through the facility maintaining a current, valid purchase contract, tariff sheet, or transportation contract for the natural gas.
- Submit required reports of the stack tests and the VEE on the four turbines to the EPA (Administrator), with copies of such reports to be sent to the DEQ.

Additionally:

- VEE - An initial visible emission evaluation (Method 22) on the stack of one of the four turbines to verify that there are no visible emissions from the operation. If visible emissions are observed when using the Method 22, the permittee shall conduct a VEE using Method 9.

Compliance with the remaining permit limits will be accomplished through recordkeeping. Recordkeeping requirements are as follows:

- Monthly and annual emission calculations for the four turbines;
- Annual count of the number of start-up/shut down events for the turbines;
- Date, time, and hours of duration of the non-standard operating modes, with the exception of the start-up / shutdown modes of the turbines;
- The number of operational hours for the emergency generator (G3);
- Monthly and annual emissions calculations for the emergency generator (G3);
- Results of all performance tests and visible emissions evaluations;
- Records of Maintenance/Operating Procedures and training; and
- Records of bypass, malfunction, shutdown, or failure of the facility or its associated air pollution control equipment.

State-only recordkeeping requirements are as follows:

- Annual emissions of formaldehyde from the four turbines.

Although the two fuel gas heaters (H2 add H3) and 35 catalytic heaters are exempt under 9 VAC 5-80-1105 B.1.a(4), the owner/operator is still required to keep records in accordance with 9 VAC 5-80-1105 A.4 to demonstrate their continued exempt status.

## IX. Title V Review - 9 VAC 5 Chapter 80, Article 1

Title V permitting applies to sources that have the potential to emit (PTE) of 100 tons per year of any criteria pollutant, *or* that exceed the 10/25 tons per year threshold for individual HAP or a combination of HAP. Referencing the below listed Table 5, after the issuance of this permit, the PTE for CO and NO<sub>x</sub> emissions from the source will exceed the 100 tpy Title V applicability threshold. The HAP PTE will remain less than the Title V applicability threshold of 10 tpy for any single HAP and 25 tpy for all HAPs combined so the facility will not be a major source of HAP.

Columbia Gas will be subject to the permitting requirements of 9 VAC 5 Chapter 80, Article 1 and will be required to submit a Form 805 application for a Title V permit within 12 months after commencing operation of the proposed emission units.

**Table 5 – Title V Applicability (tpy)**

Source	Annual Emissions (tpy) <sup>1</sup>							
	NO <sub>x</sub>	CO	PM <sub>10</sub>	PM <sub>2.5</sub>	VOC	SO <sub>2</sub>	CH <sub>2</sub> O <sup>(2)</sup>	Total HAP
Solar Titan 130 Turbine (E03) (P) <sup>3</sup>	<b>38.9</b>	<b>86</b>	4.66	4.66	4.96	0.5	0.5	0.72
Solar Taurus 70 Turbine (E04 and E05) (P) <sup>3</sup>	<b>43.8</b>	<b>92</b>	5.25	5.25	5.52	0.57	0.56	0.82
Solar Mars 100 Turbine (E06) (P) <sup>3</sup>	<b>32</b>	<b>67.7</b>	3.84	3.84	4.05	0.42	0.41	0.6
Waukesha Emerg. Generator (G3) (P) <sup>3</sup>	<b>0.97</b>	<b>1.94</b>	0.02	0.02	0.49	0.00	0.09	0.13
Turbine Venting (E03, E04, E05, and E06)	--	--	--	--	48.49	--	--	--
Fuel Gas Heater (H2)	<b>0.13</b>	<b>0.11</b>	0.01	0.01	0.0106	9.38E-04	9.66E-05	2.43E-03
Fuel Gas Heater (H3)	<b>0.11</b>	<b>0.09</b>	0.01	0.01	0.01	7.82E-04	8.05E-05	2.03E-03
Catalytic Heaters (35)	<b>1.02</b>	<b>0.86</b>	0.08	0.08	0.06	0.01	7.68E-04	0.02
<b>PTE</b>	<b>116.93</b>	<b>248.7</b>	<b>13.87</b>	<b>13.87</b>	<b>63.58</b>	<b>1.50</b>	<b>1.56</b>	<b>2.29</b>

<sup>1</sup> PM emissions are not considered for Title V applicability.

<sup>2</sup> CH<sub>2</sub>O is the chemical formula for formaldehyde.

<sup>3</sup> Permitted emission limits are denoted with a (P). All other values represent uncontrolled emissions.

<sup>4</sup> Upon issuance of this permit, the Strasburg Compressor Station will be a major source of emissions for NO<sub>x</sub> and CO.

**X. Site Suitability**

Not applicable. Site suitability analysis applies only to sources that are new (Greenfield) construction or PSD major modifications. This application does not meet those requirements.

**XI. Public Participation Requirements**

Per 9 VAC 5-80-1170 D.3, as a state major project, public notice is required for the proposed project in a local newspaper. A 30-day comment period is required. A public hearing will be held upon completion of the 30-day comment period.

The public notice will be advertised in the *Northern Virginia Daily* on September 2, 2016. A public hearing will be held on October 3, 2016. The public comment period will conclude on October 18, 2016.

**XII. Permit Fee**

The permit application fee of \$15,779 was received in two installments on January 21, 2016 and March 11, 2016.

**XIII. Other Considerations**

State Only Enforceable (SOE) Requirements:

As described in Section V and VI above, formaldehyde emissions from the compressor turbines (E03, E04, E05, and E06) will be included in the permit to maintain the SAAC. SOE requirements are included in the permit in two sections, one for the pre-modification turbine emissions, and another for the proposed operating scenario.

Formaldehyde emissions limitations and associated requirements are included in the permit as SOE to implement the requirements of 9 VAC 5-60-300, et. seq. Neither the inclusion of SOE requirements in this permit nor any resulting public comment period make these terms federally enforceable.

FLM Notification

The Federal Land Manager was notified of this permit application on January 25, 2016. A copy of the draft permit and “engrmemo” will be sent to the FLM for review and comment following completion of the peer and compliance review process.



### Previous Permitting Actions

With the exception of turbine E03, since the fuel burning equipment listed in Section II above is new, there are no previous permit actions that address these emission units. As such, the permit cover letter and the Permit Cover page will state that the permit is to “construct and operate”.

E03 was permitted on June 6, 2014 (CEDs #3). A minor amendment was issued for this facility, to allow E01 and E02 turbine operation for maintenance and testing purposes (CEDs #4). Please see the engineering memorandums for these two permitting actions for prior information regarding the turbine E03.

Historical data on the permitting history of the compressor station is found in Table 6 below.

**Table 6: Relevant CEDs Actions**

<b>Permit Date</b>	<b>CEDs #</b>	<b>Permitting Action</b>
March 21, 1997	Pre-CEDs	<u>Permitted</u> - 2 European Gas Turbine (EGT) Tornado combustions turbines/compressors, with a maximum rated capacity of 10,500 horsepower (hp) at -20 °C, a rating of 10,300 hp at an ambient temperature of 0 °C, and a site rating of 8,576 hp based on average site temperature. <u>Exempted</u> - a Waukesha F11GSI reciprocating engine/generator used solely for emergency purposes, a Wisconsin WG4D reciprocating engine/air compressor, a Hydrotherm heating system boiler, a lube oil tank, a used oil tank, and two pipeline liquid tanks
July 8, 1998	Pre-CEDs	Reduction in the required frequency of the turbines’ fuel (natural gas) sulfur monitoring, per the governing New Source Performance Standard (NSPS), Subpart GG
June 6, 2014	003	Permitted Solar 130 Turbine; add process restriction to prevent operation of two EGT turbines and Solar turbine simultaneously
April 6, 2015	004	Modify Condition 19 of the permit, a process restriction which prohibits the use of the two European turbines (E01 and E02) from operating whenever the turbine (E03) is operating.

### Compliance Review

The most recent Full Compliance Evaluation (FCE) of the Strasburg Compressor Station was conducted by David Taylor on May 14, 2015.

#### **XIV. Recommendations**

Recommend completion of the public comment period and the public hearing.

#### **Attachments**

- Attachment A – Calculations (facility; with additions by DEQ)
- Attachment A1 – Emissions Calculations (DEQ)
- Attachment A2 – Calculations (Controlled Emissions Increase)
- Attachment B – Solar Turbine Manufacturer Data Sheets for NO<sub>x</sub>, CO, and VOC (UHC) emissions
- Attachment C – Solar Turbine Product Information Letter 170 (Start-up / Shutdown Emission Estimates)
- Attachment D – Solar Turbine Product Information Letter 171, AP-42 Emission Factors (PM species), and Related 24 April 2014 E-mail
- Attachment E – BACT Analysis for the four Turbines
- Attachment F – AERSCREEN Modeling Results for Formaldehyde Emissions